The NIST Metrology Interoperability Testbed

# REPORT OF TESTING ACTIVITIES

NIST FY 2004 (Oct 1, 2003 to September 30, 2004)

## DESCRIPTION

The testbed occupies about 90 square meters of industrial floor space in the Shops building. We have general purpose computers that host several commercial software packages, a local area network, and two industrial CMMs. During FY 2004, 6 NIST staff worked on the testbed project, typically for 20-50% of their NIST project time. The testbed supports NIST involvement in the AIAG-MEPT. The extensive testing activities would not be possible without the support of the vendors who have loaned software and CMMs to NIST. More about the testbed can be found at http://www.isd.mel.nist.gov/projects/metrology_interoperability .

### Testbed Reporting Policy

NIST tests commercial products in the testbed, and records results and reports them to the AIAG-MEPT community. No vendor names are used in the reports – their purpose is to enhance understanding of interface specifications by developers, and when appropriate, to generate feedback to specification writers.

## EVENTS

### 7 CRADAs Formed

CRADAs were formed between NIST and 7 vendors of metrology products. The CRADAs are legal agreements describing the loan of software and/or hardware to NIST for open interoperability testing. New NIST CRADA partners are: Delmia, LK, Mitutoyo, Metromec, Tecnomatix, Wilcox and Zeiss.

### Two CMMs Installed

The Mitutoyo Crysta Apex 707 was installed in January. The Zeiss Contura 7/7/6 was installed just before the IMTS show, in late July.

### IMTS Show and Interoperability Demo – I++DME and DML

## DMIS TESTING

DMIS testing for FY 2004 was limited to functionality needed for the IMTS demo. A program to inspect 3 planes and 2 cylinders on the DCX test part was written by Julien Sauget of Delmia, and then edited by Kramer and Rippey. It was run initially on the in-house Mitutoyo CMM, and then on all 5 installed clients at NIST.

Our goal was initially to drive the IMTS demo using a single DMIS file to be executed or imported by the 6 software clients. We found that some DMIS statements were not supported by all clients. We edited the DMIS programs for each client to ensure compatibility. The DMIS statements that were not supported by all clients were: INCLUD,

## I++DME TESTING

Commercial client products were tested 1) with NIST test client utility, and 2) with other commercial client products. During FY2004 NIST had no commercial client software on-site, and tests were run using the internet or a telephone modem to connect the NIST test computer to remote clients in France (PD-DMIS), Germany (Zeiss), and Switzerland (Metromec/Wenzel).

**Summary of Tests**

This report does not include names of any products used in tests. We report test results, and the lessons learned for component implementers and I++DME specification specification writers.

| Client-to-NIST server | Type of issue | Description | Resolution |
|---|---|---|---|
| #1 | Client syntax error | Incorrect nesting of command arguments within parens | Fixed by client developer |
| #1 | Incompatible versions of spec | NIST server 1.3, does not accept IJK argument defined in 1.4 | Use client and server using same version of I++DME spec. |
| #2,3 | 3 clients tested, all incompatible with NIST server | NIST server version 1.3, clients version 1.4, plus client use of variable not-defined in spec, Tool.radius | |
| #4,5 | 1. Software error in client | Client issued a command from non I++DME protocol | Fixed by client developer |
| #4,5 | 2. Client protocol error | SetProp(Tool.PtMeasPar… was issued with no tool selected | Fixed by client developer |
| #6 | Improper Client use of Tool.Radius | Tool.Radius is not defined in either 1.3 or 1.4 | Spec writers should consider incorporating Tool.Radius |

| Commercial Client-to- | Type of issue | Description | Resolution |
|---|---|---|---|

| Server | | | |
|---|---|---|---|
| #1 | Protocol error | Server rejected command ChangeTool (“BaseTool”) | Clarify understanding of I++DME spec? |
| #2,3 | Protocol difference between clent and server. | OnMoveReportE command starts a Daemon- server was swamped due to multiple starts. Also, issue of % response. | Clarify understanding of spec position-reporting Daemon. |
| #4 | Successful re-run of #2,3 | Client developer changed command protocol. | |
| #5,6 | Successful tests | Two different clients tested with one server | |
| #7 | Protocol error | Client issued OnScanReport, server did not support the command | Clarify mutual understanding of spec? Need for non scanning CMM to implement “OnScanReport”? |
| #8 | Two types of protocol error by client | 1)AbortE command send without “E” tag. 2) Client sent OnMoveReportE cmd before server completed StartSession | Client developer corrected both. |
| #9-12 | Success! | 3 different clients tested with one server – inspect DCX part | |
| #13, 17 | Server software bug, later fixed and successful test run. | Server did not respond to GoTo | Software bug was fixed |
| #14,18,20 | Server rejected GoTo command due to large x,y,z values issued by Client. Later change of DMIS program resulted in successful test. | DMIS program used was different than previous version. Inspection of 3 planes was OK – problem occurred after DMIS CS transforms. | Possible math error in client, or incorrect interpretation of DMIS statements? Switch to another DMIS program later caused the problem to “go away”. |
| #19 | Successful test | Inspection of DCX part, 3 planes, 2 cylinders. | |
| #21 | Protocol disagreement | Client and server disagreed on timing of | Clarify mutual understanding of |

| | | | |
|---|---|---|---|
| | | server *done* report to OnMoveReportE command. Server did not report a done upon processing the command, client was waiting for a done before it would proceed. | server reporting "done" for the OnMoveReportE command. |
| #22,23,24 | Successful tests | 3 different clients tested with one server, inspection of DCX part. | |
| #25, 27,29 | Incomplete test | NIST operator could not completely setup the client. | |
| #26, 28-31 | Successful tests | Multiple servers and clients, inspection of DCX part in preparation for IMTS demo. | |

**DML TESTING**

Son Bui did some testing of a client installed at NIST, using DMIS programs that called for DML output files. The client is a Beta version, and Bui tested two different versions. In the early version he noted 6 errors in the DML output file that were corrected by the developer. Among the errors are: in entries for line_feature_nominal and line_feature_actual, two values are out of order, and errors in entities for plane_feature entry, circle, and diameter_delta.

NIST is developing software test utilities for DML output that can be used by developers. We also offer to do onsite testing